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...THE...

AMERICAN FERTILIZER

"That man is a benefactor to his race who makes two blades of grass to grow where but one grew before."

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Analysis of the Production of Ordinary Superphosphate in the United States in the Calendar Years 1940 and 1941*

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IN 1941 the fertilizer industry was confronted by circumstances which threatened seriously to interfere with the production of adequate supplies of phosphate fertilizer in the United States. These circumstances comprised mainly (1) dislocations and local shortages of supplies of sulphuric acid, occasioned largely by the great expansion in the manufacture of military explosives, (2) shortage of electric power for the manufacture of elemental phosphorus and the diversion of elemental phosphorus from fertilizer production to military uses, (3) shortage of boats for the transport of phosphate rock and sulphur, and (4) the exportation of substantial quantities of concentrated superphosphate under the lend-lease program.

As the formulation of plans to meet this situation required more information on the phosphate fertilizer industry than was available from accessible sources, the Office for Agricultural Defense Relations (now the Office for Agricultural War Relations), U. S. Department of Agriculture, asked the National Fertilizer Association to request certain information from all the producers of ordinary superphosphate and wet-mixed base.[1] This was done, and the data, including information on production, productive capacity, storage capacity, grades of run-of-pile materials produced, types and grades of phosphate rock used, method of transporting rock from mine to plant, and sources of sulphuric acid, were obtained for every superphosphate plant in the United States. It is believed this is the first time complete information on these matters has been assembled. Because of the great importance of ordinary superphosphate as a fertilizer material, the data should be of considerable interest and value to the fertilizer and allied industries as well as to agencies and individuals concerned with crop production and the maintenance of soil fertility. It seems desirable therefore that the information be made available, to the extent that this can be done without disclosing the operations of individual companies and plants.

The data reported in this paper are, with a few indicated exceptions, for the calendar years 1940 and 1941. Except as indicated otherwise, they relate only to the production of ordinary superphosphate and wet-mixed base in the continental United States. As the majority of the data were obtained in the last quarter of 1941 the figures for that year include estimates for the portion of the year subsequent to the submission of the respective reports of the individual companies. The estimates were made, however, by the companies themselves, and the figures for 1941

*A contribution from the Division of Soil and Fertilizer Investigations, Bureau of Plant Industry, and the Chemicals Division, Office for Agricultural War Relations, U. S. Department of Agriculture.

Grateful acknowledgment is made to The National Fertilizer Association for the distribution of the questionnaires that supplied the information upon which this paper is based, and especially to F. S. Lodge, of The Association, for many helpful suggestions on the organization of the data and for much valuable information on the general features of the superphosphate industry.

[1] The term "ordinary superphosphate" refers to the product, usually containing about 16 to 21 per cent of available P_2O_5 and consisting of a mixture of approximately equal weights of monocalcium phosphate and calcium sulphate, made by treating phosphate rock or bone with sulphuric acid. The term "wet-mixed base," or "wet-mixed goods," refers to the product made by treating a mixture of phosphate rock (or bone) and nitrogenous organic material (wool waste, fur trimmings, leather scrap, etc.) with sulphuric acid.

undoubtedly approach closely the actual productions. Since separate data were not requested on ordinary superphosphate and wet-mixed base, the figures comprise the two materials expressed in terms of 16 per cent superphosphate. As shown by the monthly reports of the Bureau of the Census, the productions of wet-mixed base in 1940 and 1941 were equivalent, respectively, to only 136,204 and 136,631 short tons of 16 per cent superphosphate.

Distribution of Superphosphate Plants

As of December 31, 1941, 146 plants, distributed among 89 cities and towns and their respective environs in 21 states, were actively engaged in the manufacture of ordinary superphosphate and (or) wet-mixed base (Table 1). Of these plants, 137 are located east of the Mississippi River and only 9 (3 in Louisiana and 2 each in Arkansas, Texas, and California) are west of the River. Division of the country on the basis of the southern boundary line of Virginia projected westward, the line of division used in the monthly reports of the Bureau of the Census, places 55 plants in the northern area and 91 in the southern area. The percentage distribution of the plants among the regions designated in Table 1 is as follows: New England 2.0, Middle Atlantic 9.6, Southern 67.8, Midwest 19.2, and Western 1.4. Nearly half of the plants are located in five states, namely, Georgia (25), Ohio (15), Alabama (14), North Carolina (12), and South Carolina (11). Fifty-nine plants are located in 14 cities and their respective environs, as follows: 6 each in Baltimore, Md., and Norfolk, Va.; 5 each in Montgomery, Ala., Atlanta and Savannah, Ga., Cincinnati, Ohio, and Charleston, S. C.; 4 each in Columbus, Ohio, and Indianapolis, Ind.; and 3 each in East St. Louis, Ill., Jack-

Table 1

Distribution of Plants Manufacturing Ordinary Superphosphate and (or) Wet-Mixed Base, as of December 31, 1941

(The data relate only to active plants.)

Region and State	Plants			Plants using phosphate rock from	
	A[1]	B[2]	Total	Florida	Tennessee and Idaho
New England[3]	1	2	3	3	0
Middle Atlantic	8	6	14	14	0
Maryland	5	1	6	6	0
New Jersey	2	2	4	4	0
New York	1	1	2	2	0
Pennsylvania	0	2	2	2	0
Southern	57	42	99	91[4]	8[5]
Alabama	6	8	14	13	1
Arkansas	0	2	2	2[6]	([6])
Florida	5	0	5	5	0
Georgia	14	11	25	25	0
Louisiana	3	1	4	4	0
Mississippi	3	3	6	5	1
North Carolina	8	4	12	12	0
South Carolina	8	3	11	11	0
Tennessee	2	7	9	3	6
Texas	1	1	2	2	0
Virginia	7	2	9	9	0
Midwest	8	20	28	5	23
Illinois	1	4	5	0	5
Indiana	0	6	6	1	5
Michigan	1	1	2	1	1
Ohio	6	9	15	3	12
Western[7]	2	0	2	0	2[8]
United States	76	70	146	113[4]	33[9]

[1] Plants having coexisting sulphuric acid plants.
[2] Plants not having sulphuric acid plants.
[3] All the plants are in Massachusetts.
[4] Including 1 plant that uses both Florida and Tennessee rock, principally the former.
[5] An additional plant uses both Florida and Tennessee rock, principally the former.
[6] One plant uses both Florida and Tennessee rock, principally the former.
[7] Both plants are in California.
[8] These plants are the only ones that use Idaho rock.
[9] Including 2 plants that use Idaho rock; an additional plant uses both Florida and Tennessee rock, principally the former.

son, Miss., Carteret, N. J., Wilmington, N. C., and Nashville, Tenn.

There are 76 plants that have coexisting facilities for the manufacture of sulphuric acid, while 70 plants do not have such facilities. It will be noted that plants having acid-making facilities are in the majority in the Middle Atlantic, Southern and Western regions but are in the minority in New England and especially in the Midwest. Acid is made at all the plants in Florida and California but at none of those in Pennsylvania, Arkansas and Indiana.

Florida phosphate rock, probably all land pebble, is used in 113 plants, namely, all those in the New England and Middle Atlantic States, 91 in the South and 5 in the Midwest. An Arkansas plant uses both Florida and Tennessee rocks, principally the former. Aside from this plant, one in Alabama and one in Mississippi, Tennessee rock is used only in Tennessee and the Midwest. Even in Tennessee, Florida rock is used in three plants. The higher mining costs of Tennessee rock and the limited supplies of the better grades of Tennessee material are factors that contribute to the use of Florida rock in areas which otherwise would be served exclusively from the Tennessee deposits. Idaho rock is used in the two California plants.

The data in Table 1 relate only to active plants as of December 31, 1941. One company, operating one plant which used Florida rock and had coexisting acid-making facilities, ceased the manufacture of superphosphate in June, 1941. Seven inactive plants, all of which are in the South and not included in Table 1, are reported to be in such condition that they can be operated without extensive repair and (or) purchase of new equipment. These plants, none of which has acid-making facilities, did not operate in 1941 and are not expected to operate in 1942.

Changes in the number of superphosphate plants during the period 1920 to 1941 are indicated in Table 2. The data for 1920, 1930 and 1940 were compiled mainly from the respective issues of *The American Fertilizer Hand Book*. The lists given in the *Hand Book* show the names of subsidiary, allied and affiliated companies, as well as those of operating companies and parent organizations, usually with no indication of the number of plants involved and their operative condition. Although an attempt has been made to restrict the figures in Table 2 to actual individual plants, the data for 1920, 1930 and 1940 likely include some duplications and they undoubtedly include a number of inactive plants. As the data for 1941 relate only to plants actually active in that year, they are not comparable to those for the preceding years.

Despite the inaccuracies in the previous data, there is no doubt that the number of plants has decreased markedly in the past 22 years. For the period 1920 to 1940, the figures indicate a decrease of 20.5 per cent in the total number of plants, compared to a decrease of 32.8 per cent in plants having coexisting acid-making facilities and only 2.2 per cent in those not having such facilities. It will be noted that the greatest changes have occurred in the older fertilizer-consuming regions, namely, in the South and along the Atlantic Coast.

The trend has been definitely in the direction of the abandonment of small and poorly located plants and the concentration of production in larger plants capable of more economical operation and better situated with respect to transportation facilities and con-

Table 2

Plants for the Manufacture of Ordinary Superphosphate and (or) Wet-Mixed Base, 1920 to 1941
(The data for 1920, 1930 and 1940 were compiled mainly from the respective issues of *The American Fertilizer Hand Book;* the figures undoubtedly include a number of inactive plants. The data for 1941 were compiled from information supplied directly by all producers; the figures relate only to plants that were active in 1941.)

Region	Plants having coexisting acid-making facilities				Plants not having coexisting acid-making facilities				Total[1]			
	1920	1930	1940	1941	1920	1930	1940	1941	1920	1930	1940	1941
New England...	5	3	2	1	3	1	2	2	8	4	4	3
Middle Atlantic.	17	13	11	9[2]	15	11	7	6	32	24	18	15[2]
Southern.....	97	77	67	57	51	61	56	42[3]	148	138	123	99[3]
Midwest.....	12	8	7	8	20	23	23	20	32	31	30	28
Western.....	3	3	3	2	1	0	0	0	4	3	3	2
United States...	134	104	90	77[2]	90	96	88	70[3]	224	200	178	147[2, 3]

[1] 128 companies in 1920, 88 in 1930, 70 in 1940 and 55 in 1941; the figure for 1941 includes 1 company, operating 1 plant, that ceased the manufacture of superphosphate in 1941.
[2] Including 1 plant that ceased the manufacture of superphosphate in 1941.
[3] There are 7 additional plants that could be operated without extensive repair and (or) purchase of new equipment.

suming territories. The marked decrease in the number of plants having coexisting acid-making facilities is of particular interest, as it clearly shows that the superphosphate industry has become more dependent upon extraplant sources of sulphuric acid. Because plant size and continuity of production are important factors in the economical operation of sulphuric acid plants, it is only logical that the manufacturer of acid should tend to become concentrated in larger plants and in localities where the demand for acid for non-fertilizer purposes is such as to permit continued operation in the off-season periods of superphosphate production. Also, the expansion in the manufacture of cheap sulphuric acid as a byproduct of the smelting of copper and zinc ores has been a factor in the abandonment of acid production at certain superphosphate plants.

As indicated in Table 2, footnote 1, the number of companies operating superphosphate plants decreased from 128 in 1920 to 70 in 1940—a reduction of 45.3 per cent as compared to a decrease of 20.5 per cent in the number of plants operated. In 1941, 55 companies actually produced ordinary superphosphate and (or) wet-mixed base. In compiling the data for 1941, companies operating under different names but having the same officials are included as one company, as are companies known to be subsidiaries of, or controlled by, another company; it is believed, therefore, that the figure represents the actual number of companies under entirely separate ownership and management. Although the same procedure was followed in compiling the data for 1920, 1930 and 1940, strict accuracy is not claimed for the figures

(Continued on page 24)

Table 3

Capacity of Plants Manufacturing Ordinary Superphosphate and (or) Wet-Mixed Base, as of December 31, 1941
(Includes all grades of ordinary superphosphate and wet-mixed base, expressed as equivalent 16 per cent superphosphate. The data relate only to active plants.)

Region and State	Plants	Annual productive capacity[1]		Storage capacity[2]		Relation of storage capacity to productive capacity		
		Average	Total	Average	Total	Range	Average[3]	Total
	Number	Short tons	Short tons	Short tons	Short tons	Per cent	Per cent	Per cent
New England[4]	3	80,200	240,600	20,250	60,750	15.0– 49.0	31.0	25.0
Middle Atlantic	14	159,650	2,234,800	25,250	353,800	9.0– 28.5	16.5	16.0
Maryland	6	245,450	1,472,600	41,700	250,300	10.0– 24.0	15.0	17.0
New Jersey	4	109,700	438,800	14,600	58,500	9.5– 20.0	16.5	13.5
New York and Pennsylvania	4	80,850	323,400	11,250	45,000	9.0– 28.5	19.5	14.0
Southern	99	55,050	5,450,100	13,300	1,315,850	2.5–100.0	27.5	24.0
Alabama	14	43,950	615,400	12,700	177,750	13.5– 62.5	30.5	29.0
Arkansas and Texas	4	59,050	236,200	12,650	50,600	16.5– 28.5	21.5	21.5
Florida	5	82,600	412,900	12,150	60,750	12.5– 18.0	15.0	14.5
Georgia	25	51,200	1,279,700	14,600	364,700	2.5– 56.5	27.5	28.5
Louisiana	4	61,000	244,100	11,550	46,100	6.5– 60.0	27.5	19.0
Mississippi	6	38,550	231,200	10,050	60,200	14.5– 74.0	33.5	26.0
North Carolina	12	49,450	593,400	12,600	151,300	16.5–100.0	32.0	25.5
South Carolina	11	63,800	702,000	13,500	148,500	12.0– 83.5	28.0	21.0
Tennessee	9	51,900	466,900	14,000	126,000	14.0– 43.5	29.0	27.0
Virginia	9	74,250	668,300	14,450	129,950	14.0– 48.0	21.0	19.5
Midwest[5]	26	53,650	1,394,400	13,600	353,200	14.0– 41.5	26.5	25.5
Illinois	5	69,100	345,400	19,150	95,650	22.5– 40.0	28.0	27.5
Indiana	6	39,550	237,400	10,750	64,600	18.5– 38.5	27.5	27.0
Michigan[6]	...	.....	.....	.....	.....	.....	....	....
Ohio	15	54,100	811,600	12,850	192,950	14.0– 41.5	26.0	24.0
Undistributed[7]	4	40,800	163,100	10,150	40,500	17.5– 40.0	30.5	24.5
United States[8]	146	64,950	9,483,000	14,550	2,124,100	2.5–100.0	26.5	22.5

[1] Based on the assumption that adequate supplies of phosphate rock, sulphuric acid and labor are available, that two or more shifts are operated, that the superphosphate is removed from the plant at the end of the normal curing period or within 60 to 90 days, and that there is no interference with the normal functioning of the plant for other purposes, for example, the manufacture of mixed fertilizers.
[2] Based on the assumption that there is no interference with the normal functioning of the plant for other purposes, for example, the manufacture of mixed fertilizers.
[3] Average of figures for individual plants.
[4] All the plants are in Massachusetts.
[5] Except Michigan, which is included with undistributed States.
[6] Included with undistributed States.
[7] California 2 plants and Michigan 2 plants.
[8] Also, there are 7 inactive plants that could be placed in operation without extensive repair and (or) purchase of new equipment; these plants have total productive and storage capacities equivalent to 265,500 and 60,800 short tons of 16 per cent superphosphate, respectively.

Superphosphate Production Continues to Increase

In each month from February, 1941, through May, 1942, production of superphosphate was larger than in the corresponding month of the preceding year. Production at plants of acidulators which report to the National Fertilizer Association was larger in May than in any other May for which records are available, exceeding May, 1941, by 13 per cent. The increase over last year was about evenly distributed between the northern and southern areas. Production during the month was a little larger than in April, following the usual seasonal pattern.

Superphosphate Production, Shipments, and Stocks for May and January-May, 1942 and 1941

Expressed throughout in equivalent tons of 16% A. P. A. Based on reports by acidulators to the National Fertilizer Association.†

	United States	
May	1942	1941
Stocks—First of month:		
Bulk superhhosphate	638,664	669,834
Base and mixed goods	218,979	551,327
Production:		
Bulk superphosphate	370,172	326,821
Base and mixed goods	13,445	14,527
Total Production	383,617	341,348
Other Receipts*	37,153	39,371
Book Adjustments	−12,139	1616
Total Supply	1,266,274	1,402,496
Shipments:		
Superphosphate:		
To mixers	139,530	133,627
To other acidulators	53,511	56,053
To consumers, etc	124,725	120,666
Total Superphosphate	317,766	310,346
Base and mixed goods	145,533	228,517
Total Shipments	463,299	538,863
Stocks—End of month:		
Bulk superphosphate	669,115	655,227
Base and mixed goods	133,860	208,406
Total Stocks	802,975	863,633

Accumulated Production and Shipments for January-May

Production:		
Bulk superphosphate	1,956,989	1,646,589
Base and mixed goods	65,138	61,348
Total Production	2,022,127	1,707,937
Shipments:		
Superphosphate:		
To mixers	836,079	740,862
To other acidulators	274,560	338,730
To consumers, etc	712,128	699,413
Total Superphosphate	1,822,767	1,779,005
Based and mixed goods	1,224,385	1,070,792
Total Shipments	3,047,152	2,849,797

†Represents approximately 85% of total production.
*Includes inter-company transfers.
Base includes wet and/or dry base.

For the first time since January, 1941, stocks of bulk superphosphate have risen to a level above that of a year earlier. Stocks at the close of May were moderately larger than they had been at the end of May, 1941, but this increase in stocks of bulk superphosphate was much more than offset by the sharply lower level of stocks of base and mixed goods.

Shipments from plants in the northern area in May fell below last year, with the decline only partially compensated for by a rise in shipments from plants in the South.

Obituary

Dr. Henry G. Knight

Dr. Henry Granger Knight, Chief of the Bureau of Agricultural Chemistry and Engineering in the U. S. Department of Agriculture, died on July 13th in Washington, after a short illness. He was 63 years of age.

Dr. Knight was born in Kansas and received his bachelor's and Master's degrees from the University of Washington and his doctor's degree from the University of Illinois. He also studied at the University of Chicago and at Cornell University.

After teaching at various schools, Dr. Knight was appointed state chemist and later director of the agricultural experiment station of Wyoming. In 1922, he became research chemist and director of the Experiment Station of West Virginia and dean of the College of Agriculture.

In 1927, Dr. Knight was appointed Chief of the Bureau of Chemistry and Soils (now the Bureau of Agricultural Chemistry and Engineering) in the U. S. Department of Agriculture. In the past few years, his Bureau has organized the four Regional Research Laboratories for the development of industrial uses of farm crops.

In 1941, Dr. Knight received the Medal of the American Institute of Chemists, presented annually "for noteworthy and outstanding service to the science of chemistry in America.

He is survived by his wife and one son, Richard Knight.

A. F. Detweiler

A. F. Detweiler, division manager of Armour Fertilizer Works at Presque Isle, Maine, died on June 6th. Mr. Detweiler was well known in New England Agricultural circles having been connected with the Armour organization for the past 20 years. He was appointed division manager at Presque Islein 1926.

Practical Agronomy In War Time*

By ROBERT M. SALTER

Chief, Bureau of plant Industry, U. S. Department of Agriculture

PREPAREDNESS on the American farm front promises to be a powerful asset of the United Nations in the present conflict. In part, this preparedness springs from the progress of agricultural science during the quarter century since World War I. In part, it derives from devices developed during the past decade for cooperative attack by the farmer and his Government upon the problems of agricultural production. Fortified by the tools of science on one hand and by the machinery for collective action on the other, American agriculture faces its present responsibilities with confidence, stupendous though those responsibilities now appear.

Since efficiency in crop production is so vital to attaining maximum agricultural output, and since fertilizers contribute much toward this efficiency, it may be appropriate to review briefly a few of the advances made in agronomy—the science of crop production—in the 25 years that have elapsed since 1917. In doing this it is necessary to recognize that agronomy actually comprises parts of many sciences. The soil chemist, the soil physicist, the soil bacteriologist, the plant breeder, the plant physiologist, the plant pathologist, the entomologist, and others make their contribution to the science we call agronomy. These scientists are for the most part employed by our State agricultural experiment stations and colleges and by the United States Department of Agriculture, but many important contributions have been made by research workers in industry and through the cooperation of public and private agencies.

No attempt will be made to paint a complete picture of the progress that has been made in recent years in all of the sciences that are related to fertilizer use, but I do want to cite a few examples, first, in what might be called the allied or related sciences, and, secondly, in fields more directly concerned with fertilizers. In the third place, I should like to say something about the relationship between crop production and the nutrition of animals and people.

Phenomenal progress has been made by plant breeders in increasing the yield and improving the quality of our crops. Taking advantage of the wide range of heritable characters existent in our crop plants, they have succeeded, through breeding, in eliminating the undesirable and in retaining and combining the desirable. In this way crops have been bred that are resistant to some of our most destructive plant diseases, crops that are immune to attack by certain insect pests, crops that will withstand drought, or heat or cold, crops that contain more of the important nutritional factors needed by men or animals, crops that ship better and are more attractive to the consumer. These accomplishments have import to the fertilizer industry. As the factors that limit the production of a crop are eliminated one by one through breeding and other means, more and more does the supply of plantfood available for its nutrition assume importance in determining its production.

Take hybrid corn, for example. In the corn belt about nine out of every ten acres of corn are now planted to hybrids. Fields per acre have been stepped up from 15 to as much as 30 per cent. These higher yields can mean only one thing as regards plantfood; they demand higher levels of supply. In fact, it has already been demonstrated that these high-yielding corn hybrids will respond economically to higher levels of fertilizer application than open-pollinated corns. Corn breeding in the South has lagged somewhat but is now developing rapidly. With the coming of better strains of corn, the increased need and use of fertilizers in this important corn-growing region may be taken for granted.

Notable progress has been made in the last 10 to 15 years in breeding varieties of cotton that have longer staple and more resistance to disease. Wheats that are higher yielding, more resistant to disease and winter injury, that have better milling, baking, and nutritional qualities have been developed one after another for many years. Attention is now being given to increasing the vitamin B_1 content of this crop. Oats was not an important crop in the South until breeders brought in leaf rust-resistant blood from South America and introduced it into our southern varieties. A phenomenal increase in oat acreage is now

*Address delivered at the Annual Convention of the National Fertilizer Association, Hot Springs Virginia, June 20, 1942.

occurring throughout the South. This has great significance in the development of a source of pasture for livestock and in the control of soil erosion. Some of you have reason for appreciating its significance as regards the need for fertilizer, especially nitrates for top-dressing.

In the early twenties the sugar cane crop was threatened with destruction by mosaic disease, and by 1926 sugar production had dropped to 40,000 tons. Disease-resistant strains were imported from Java and new disease-resistant varieties were developed by breeding. The industry was saved, and this year our sugar production from cane should be close to half a million tons.

The story of sugar beets west of the Rockies is much the same. A few years back the industry appeared threatened with extinction because of the "curly top" disease. Breeders developed disease-resistant strains, an American seed production industry was born, and the western sugar beet industry survived.

Equally significant progress has been made in breeding better tomatoes, cantaloupes, lettuce, cabbage, potatoes, berries, citrus fruits, orchard fruits, and many others. The present Nation-wide program of forage and pasture crop breeding promises to lower livestock production costs generally, to facilitate the expansion of the industry in the South, and to stabilize it in the West.

Altogether, these improvements in crops should contribute much toward our task of meeting the Nation's present needs for food and fiber. That they also emphasize the need for plantfood and point to increased use of fertilizers will not escape the attention of the fertilizer industry.

Research in Ferilizer Use

Now I shall mention a few rather fundamental lines of research that affect fertilizer use and in which definite progress has been made. The use of free ammonia in fertilizers began about 1928, following a decade of intensive research on the fixation of atmospheric nitrogen. You are all familiar with this development and you, better than anyone else, realize the problems that were created for you when ammonia solutions were withdrawn from the fertilizer market. However, before free ammonia could be used to any great extent in mixed fertilizers, it was necessary to solve the problem of phosphate fixation associated with ammoniation and to devise a new method of determining available phosphoric acid that would recognize the fact that some of the so-called reverted phosphoric acid is still available to crops. Today, anticipating an abundance of cheap nitrogen after the war, many agronomists are speculating on the possibility that much more free ammonia can be used in mixed fertilizers without loss of actual phosphate availability, and experiments are under way now to see how far we can go in this direction.

It is only necessary to mention fertilizer application to bring to your minds the great progress that has been made in developing better methods of applying fertilizers to crops. Your Association has taken part in that development and has made a definite contribution.

Twenty-five years ago we in the Middle West were advising farmers to apply fertilizer broadcast for corn, but a good many insisted on applying it in the row. It is true that they got some unsatisfactory results, but it is also true that when they applied it broadcast the results were not always impressive. Today, through the improvement of fertilizer attachments on corn planters, much greater efficiency is being obtained from the fertilizers used on that crop. I need not go into details, but as a result of the research program that has been carried on for more than twenty years we have learned both where and how fertilizer should be applied. Machinery for planting and fertilizing most crops has been improved, and the increased yields obtained through these better methods of applying fertilizers add many millions of dollars to the farmers' income annually.

Pastures were almost entirely unfertilized twenty-five years ago, and farmers were told by their agricultural colleges and experiment stations that if crops were fed to livestock and the manure applied to the land commercial fertilizers were not needed. Today, as the result of hundreds of experiments and thousands of demonstrations, livestock and dairy farmers have begun to use substantial quantities of fertilizers on their pastures and there is still a large undeveloped market for your product in this field.

Although carefully conducted field experiments have long been regarded as essential in determining the fertilizer needs of soils and crops, such experiments have been completely overhauled in recent years so that results now being obtained are both more accurate and more practical. This is not a criticism of the early experiments. They were designed primarily to explore the need of plantfood elements and gave a lot of invaluable information. The new experiments are designed to measure accurately the much smaller yield differences necessary in deter-

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Principle Articles in This Issue

Further Fertilizer Conferences

Louisiana, Texas and Arkansas

The fertilizer conferences held at Shreveport, La., July 8th and 9th, were attended by nearly 100 persons including about 30 representatives of the Federal Government and of the State agricultural colleges and departments of agriculture. The usual grade conference arranged by the control officials was held during the forenoon on the 8th. Commissioner Harry D. Wilson of Louisiana served as general chairman, and Dr. G. S. Fraps and Dr. Wm. F. Manglesdorf presided while grades for Texas and Arkansas were under discussion.

The agronomists, control officials, and Federal representatives met all afternoon and evening on the 8th to discuss the fertilizer supply situation and to select a list of grades for each State to be recommended for use during the war emergency period. It was agreed that the best way to insure equitable distribution of limited nitrogen supplies would be to reduce the average nitrogen content of all complete fertilizers. This has the further advantage of encouraging normal applications of phosphate and potash, supplies of which barring transportation difficulties are expected to be normal.

This conference was called to order by H. R. Smalley, and Dr. R. P. Bartholomew of Arkansas was elected chairman. F. W. Parker of OPA led the discussion, the other Federal representatives present being T. E. Milliman and Wm. H. Martin of WPB, W. F. Watkins, S. B. Akins, and A. L. Mehring of USDA. Louisiana was represented by Harry D. Wilson, A. P. Kerr, M. B. Sturgis, R. A. Wasson, Dawson M. Johnson, and M. S. Perkins; Arkansas by R. P. Bartholomew, W. F. Manglesdorf, J. R. Cooper, and C. F. Simmons; Texas by G. S. Fraps, E. A. Miller, and W. H. Friend. The National Fertilizer Association was represented by Messrs. Brand and Smalley, and by H. B. Siems and H. B. Mann, chairman and member, respectively, of the Flantfood Research Committee.

The lists of grades selected include 8 for Arkansas, 9 for Louisiana, 8 for Texas, and 5 for Oklahoma. The conference went on record as recommending that all chemical nitrogen be omitted from mixed fertilizers for use on small grains this fall.

The conference on the 9th was called to order by T. E. Milliman, who introduced Dr. F. W. Parker as chairman for the day. Mr. Milliman then discussed the supply situation fully. W. F. Watkins of USDA spoke on crop

goals and nitrogen needs; Dr. W. H. Martin described the action taken at the conferences held in the Middle Atlantic and Middle Western States; and Dr. Parker spoke briefly on the reasons for grade reduction. Dr. R. P. Bartholomew then presented the recommendations of the agronomic conference. The recommendations were discussed at some length by industry representatives and were revised by eliminating two grades and adding one. Four of the leading tonnage grades are recommended in all four States, which will of course greatly simplify manufacture.

Alabama, Mississippi and Tennessee

At the Birmingham meeting on July 10th a short general session was held, and the agronomic conference then convened. Dr. Clarence Dorman, director, Mississippi Experiment Station, was elected chairman for the day, and Dr. F. W. Parker assisted in handling the discussion as to grades. The State representatives were Commissioner Haygood Faterson, Dr. N. J. Volk, J. C. Lowery, James A. Naftel, and J. T. Williamson of Alabama; Dr. Dorman, Dr. W. B. Andrews, Roy Kuykendall, J. M. Weeks, and R. A. Maddox of Mississippi; and H. E. Hendricks of Tennessee. The Federal men present were: S. B. Akins, W. H. Martin, A. L. Mehring, T. E. Milliman, F. W. Parker, and W. F. Watkins; and the National Fertilizer Association was represented by Messrs. Brand, Smalley, Siems, and Mann.

The lists of grades to be recommended at the general conference in Atlanta will include 4 for Alabama, 6 for Mississippi, and 9 for Tennessee. The conference also went on record as favoring the elimination of chemical nitrogen from mixed fertilizers for use on small grains this fall.

There was considerable discussion as to whether it would be best to maintain normal nitrogen content in mixed fertilizers and reduce tonnage, or reduce the nitrogen content and maintain normal tonnage.

CLASSIFIED ADVERTISEMENTS

Advertisements for sale of plants, machinery, etc., and for help and employment, in this column, same type as now used, 60 cents per line, each insertion.

WANTED—Fertilizer Chemist for factory control work. Position pays $40.00 per week. Apply with references to F. W. Tunnell & Company, 15 N. 5th Street, Philadelphia, Pa.

Explosives License Needed For Chemical Fertilizer Nitrates

On June 22nd the U. S. Bureau of Mines revised the Regulations of the Federal Explosives Act so as to require the licensing of all persons and establishments handling "explosives" or "ingredients." Included in the list of chemicals covered by the regulations are sodium nitrate, ammonium nitrate, and potassium nitrate, thus affecting the fertilizer industry and bringing it within the provisions of the act.

There are five different kinds of license: manufacturer's license, vendor's license, purchaser's license, foreman's license, and analyst's-educator's-inventor's-investigator's license.

For the use of "explosives" or "ingredients" in making mixed fertilizer, a fertilizer manufacturer will require a purchaser's license. The same license would authorize the use of "explosives" for breaking down piles.

To avoid the necessity for a license for each of his employees who handles "explosives" or "ingredients" for use on the operating premises, a fertilizer manufacturer may arrange for foreman's licenses for appropriate employees. The application for a foreman's license must be executed by the foreman and endorsed by his employer.

For the purchase of "explosives" or "ingredients" and their resale as such, that is, not so mixed that their identity is lost (for example, nitrate of soda), a fertilizer manufacturer will require also a vendor's license.

A fertilizer manufacturer operating more than one plant under the same identical name need not have a separate license or separate licenses for each plant. However, at each plant where the original license or licenses are not kept, there should be kept a certified copy or a photostatic copy of each original license.

To have in possession or sell "explosives" or "ingredients," a fertilizer dealer or agent will require a vendor's license.

A farmer who purchases "explosives" or "ingredients" for his own use will require a purchaser's license. However, the Bureau of Mines has issued a general license to farmers for the purchase and possession of sodium nitrate for use as a fertilizer.

Applications for licenses must be made on forms which may be obtained from the Bureau of Mines or from Licensing Agents. There are approximately 4,400 of these Licensing Agents scattered throughout the country. In general, they are well known residents of their communities.

June Tag Sales

Sales of fertilizer tax tags in the 17 reporting States in June represented 160,000 tons, compared with 144,000 tons a year ago, and 149,000 tons two years ago.

The increase over last year was due to larger sales in the South. Ten of the twelve Southern States reported sales increases over June 1941, resulting in a 42 per cent increase for the region as a whole. Aggregate sales in the five Midwestern States were less than a third as large as a year ago.

Total sales in the fiscal year ended with June were 3 per cent larger in each geographic area than they were in 1940–1941.

Sales in the January-June period of each of the last three years are shown below.

	1942	*1941*	*1940*
South	4,381,096	4,405,285	4,200,366
Midwest	459,336	422,277	354,734
Total	4,840,432	4,827,562	4,555,100

Plenty of Magnesium for Fertilizers

Magnesium, one of the critical war metals, is also an essential fertilizer element on some soils, but there is no prospect of a shortage of magnesium for fertilizers, say Colin W. Whittaker and William M. Ross of the U. S. Department of Agriculture who have studied the supply situation.

With foreign supplies of soluble magnesium salts cut off, fertilizer manufacturers turned to various forms of magnesium oxide, one of which is obtained by heating dolomite. The heating changes the magnesium in the dolomite to a more soluble form. In areas where the problem is merely the prevention of a magnesian shortage, and not the need for a quick-acting remedy, the indications are that use of dolomite in mixed fertilizers or in liming fields will supply magnesium that will gradually become available.

FERTILIZER TAX TAG SALES

State	June 1942 Per Cent of '41	June 1942 Tons	June 1941 Tons	June 1940 Tons	July–June 1941-42 Per Cent of '40-'41	July–June 1941-42 Tons	July–June 1940-41 Tons	July–June 1939-40 Tons
Virginia	105	9,685	9,246	9,289	104	416,231	400,047	396,772
N. Carolina	174	35,161	20,176	32,852	109	1,194,175	1,095,327	1,084,721
S. Carolina	81	14,040	17,352	16,250	93	659,412	712,115	678,449
Georgia	231	16,669	7,224	14,210	99	788,111	793,601	736,836
Florida	116	33,396	28,714	28,200	113	689,073	612,230	582,667
Alabama	230	13,550	5,900	7,050	99	571,350	578,050	576,350
Mississippi	110	10,711	9,750	9,675	98	333,976	342,455	345,010
Tennessee	288	4,752	1,648	2,040	110	163,064	148,387	135,112
Arkansas	307	2,300	750	300	118	140,950	119,650	102,600
Louisiana	312	5,550	1,780	1,350	99	168,986	171,474	169,673
Texas	172	1,915	1,114	325	100	133,608	133,354	116,758
Oklahoma		0	120	16	106	11,386	10,790	6,872
Total South	142	147,729	103,774	121,557	103	5,270,322	5,117,480	4,931,820
Indiana		1,587	35,354	18,300	99	342,355	345,264	299,213
Illinois	149	112	75	37	127	78,838	62,101	50,079
Kentucky	50	2,148	4,325	9,021	113	140,736	124,799	123,715
Missouri		2,916	20	20	89	86,511	97,701	73,044
Kansas		5,028	0	55	96	19,910	20,786	15,624
Total Midwest	30	11,791	39,774	27,433	103	663,350	650,651	561,675
Grand Total	111	159,520	143,548	148,990	103	5,938,672	5,768,131	5,493,495

FERTILIZER MATERIALS MARKET

NEW YORK

Sulphate of Ammonia Allocation Schedule Announced. Mid-Western Supply Reduced Drastically. Potash Supply Smaller than Expected.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, July 14, 1942.

Sulphate of Ammonia.—Last week notification was received by producers of sulphate of ammonia and agents and brokers for the sale of this commodity, advising them that the first allocation of sulphate of ammonia for the coming year was to be mailed within a few days.

This allocation advised fertilizer manufacturers and mixers that they might purchase definite tonnages of sulphate of ammonia in the usual manner and through the usual channels. This advice to the producers and agents or brokers advised that they might proceed to make contracts for the coming year.

In order to facilitate prompt shipments against these contracts not yet made, it was permitted to make shipments in July against the contracts except into the middle western states and the states north of and including Kentucky, West Virginia and Virginia. However, it was requested that by the end of this month the record of all these July shipments would be filed with the War Production Board in Washington.

Form PD-237 for August shipments must be received in Washington by July 30th and no shipments for August can be made without authorization from the War Production Board.

The allocation of sulphate of ammonia drastically reduced the supply for the mid-western states, these states only having been allocated about 9 per cent of their last year's consumption.

Further, no price has as yet been made for contracts for the new year but it is expected that the price will be released this week and, with the reduction of sulphate of ammonia deliveries to the mid-western states, which meant a higher return in most cases to producers, it is possible that the OPA will authorize a slightly higher price than last year's contract price.

Potash.—The fertilizer manufacturers have booked their muriate of potash to the utmost but, in spite of the expectation that there would be ample muriate to take care of all domestic needs, many of the buyers have been unable to book their anticipated requirements of this commodity, several of the larger producing companies having reduced quantities which the buyers expected they would receive from them. Many buyers are, therefore, trying to book additional quantities of muriats.

Nitrate of Soda.—Nitrate of soda continues scarce and deliveries of same is continuing under allocation but this material now comes under the act and regulations requiring licensing as an explosive or ingredient thereof.

Fertilizer manufacturers will require a license for the purchase of this commodity and farmers will also require a purchasers license for the purchase and possession of nitrate of soda but the Bureau of Mines has issued a general license to farmers.

Fish Scrap.—The price of fish scrap remains the same, material scarce.

BALTIMORE

Ammonia Supplies Cause Concern. Organic Materials Limited. Bag Situation Somewhat Improved.

Exclusive Correspondence to "The American Fertilizer"

BALTIMORE, July 14, 1942.

The main concern of the fertilizer industry at the present time is the question of supplies of liquid and mineral ammonia for the coming spring season's business. It has now been definitely confirmed that supplies will be allocated under OPA supervision, in order to conserve supplies for munition purposes. In the meanwhile, the tonnage of ammonia in organic form at prices within range of fertilizer manufacturers is very limited and, on account of uncertainties of supplies, pro-

ducers of organic ammoniates are not anxious to sell ahead.

Ammoniates.—The market on ground tankage continues to be quoted at ceiling price of $6.00 per unit of nitrogen, f. o. b..

Nitrogenous Material.—Due to the situation surrounding liquid and mineral ammonia and scarcity of supplies of raw materials, there are no offerings of nitrogenous on the market at the present time.

Sulphate of Ammonia.—No prices have been issued by first hands, but it is understood that OPA is opposed to advancing prices, even in spite of increased freight rates and higher cost of production.

Nitrate of Soda.—It is evident that the schedule on this commodity will be quoted from month to month, and importers of the Chilean product have extended quotations to the end of this month at the same price as last, namely—$33.00 per ton of 2,000 lb., in 100-lb. bags, with usual differential for larger bags and in bulk.

Fish Meal.—Due to restricted fishing area, the catch continues light, and there have not been any reports of further important sales.

Superphosphate.—Manufacturers continue to quote ceiling price of $9.60 per ton of 2,000 lb., basis 16 per cent for run-of-pile, and $10.10 for flat 16 per cent grade, both in bulk, f. o. b. producers' works, Baltimore.

Bone Meal.—There are practically no offerings on the market which remains quiet without much interest being shown.

Potash.—From all accounts, it would appear that the various manufacturers have been able to contract for their supplies for the coming season's business with domestic manufacturers.

Bags.—The situation on burlap is still critical and, due to the even higher price ruling on cotton bags, it would appear that the burden during the coming season will again be on paper bags, where the situation is ruling much easier than some months ago.

ATLANTA

Sulphate of Ammonia Allocations Begin. Increased Interest Shown in Organic Ammoniates.

Exclusive Correspondence to "The American Fertilizer"

ATLANTA, July 14, 1942.

Fertilizer mixers and manufacturers are now receiving notice of their allocations of sulphate of ammonia from the War Production Board. Orders are being booked, although there is still some uncertainty as to the price which will prevail for the current season. The trade is hoping for early clarification of the price situation. In most quarters the general opinion is that sulphate prices will rule about the same as this past season.

The trade is showing renewed interest in organic ammoniates; many are beginning to realize that organics will have to take the place of a certain amount of mineral nitrogen.

Superphosphate producers who submitted bids to the Department of Agriculture on July 6th are awaiting word as to tonnage which has been accepted. Superphosphate still remains in a strong position, with some producers as yet not quoting a price to the mixers at interior producing points.

Nitrate of soda deliveries continue against June allotments.

Manufacturers are watching the vegetable oil meal situation carefully, realizing they will have to turn to these materials for an important part of their nitrogen requirements for the spring mixing season.

The fertilizer manufacturers are not purchasing any cottonseed, peanut or soya meals, awaiting the program which is to be set up by the Commodity Credit Corporation to handle the expected larger crop.

Eight per cent grade cottonseed meal is selling at $36.00 to $37.50, f. o. b. Georgia points; up to $38.00 in Carolina; and approximately $35.00 to $36.00 in Mississippi and Tennessee.

CHICAGO

Fertilizer Organic Market Quiet with Few Offerings. Feed Market Active with Small Tonnage.

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, July 13, 1942.

No new developments have occurred in the organic market, and a generally quiet but firm situation continues. Offerings are slow in coming to light, sellers professing well sold-up positions, and a somewhat reduced supply of raw material.

Demand for feed material at ceiling prices continues active. Available offerings are meager and, while odd lots are being booked, the aggregate tonnage is comparatively small.

Nominal prices are as follows: High grade ground fertilizer tankage, $3.85 to $4.00 ($4.68 to $4.86 per unit N), and 10 cents; standard grades crushed feeding tankage, $5.37 ($6.53 per unit N); blood, $5.65 to $5.75 ($6.87 to $6.99 per unit N); dry rendered tankage, $1.21 per unit of protein, Chicago basis.

TENNESSEE PHOSPHATES

Mining Operations Continue at High Level. New Plants in Operation at High Efficiency.

Exclusive Correspondence to "The American Fertilizer"

COLUMBIA, TENN., July 13, 1942.

Two or three of the heaviest rains this section has known in many days have visited parts of the area, but some sections have not had a decent rain for ten days. The corn and tobacco crops are spotted between the best ever seen here and some looking mighty spindly for want of moisture, with pastures likewise, and lots of small grain still in the shock waiting for a chance to thresh.

Phosphate operations continue at high point of activity, and instead of June and July shipments showing great valleys or depressions in the curve of yearly shipments as has been the case for forty years, this year's business curve for those months almost shows a peak. As a matter of fact, ever since December, 1941, the mills engaged in producing ground rock for direct application to the soil by farmers have been running steadily and shipments have been loaded direct from the mills as fast as produced, leaving no opportunity for accumulating stocks to supplement shipments in the ordinarily extra-active months of March/April and August/September.

Orders on file for shipment cover the entire estimated output for 1942 and orders are being rapidly filed for 1943 shipments.

Leading producers of ground rock had already announced in February an advance of 50 cents per ton effective July 1st, and billings are being made on that basis. Of course, on any decision by OPA that the March actual billings constitute ceiling, this advance may be removed, but as some billings were actually higher, a strict interpretation by OPA might even advance the February announced price another 25 cents per ton.

The TVA mining and washing plant at Bear Creek, and the preparation and sintering plant at Godwin, are practically complete and in partial operation, shipping dried phosphate sand of very high grade to Muscle Shoals. The plant is the last word in construction and design. It combines dragline removal of overburden and mining, with hydraulic transportation from mine to washer and washer to preparation plant, a distance of about three miles, with an inexhaustible supply of water from Duck River. With its entire absence of tram lines and cars, it presents a view of operations not to be seen anywhere else in the field, since the old Ruhm plant burned down in 1926. With the complete installation of labor-saving facilities everywhere, the labor and material cost should be about the lowest in the field. As an operating proposition it

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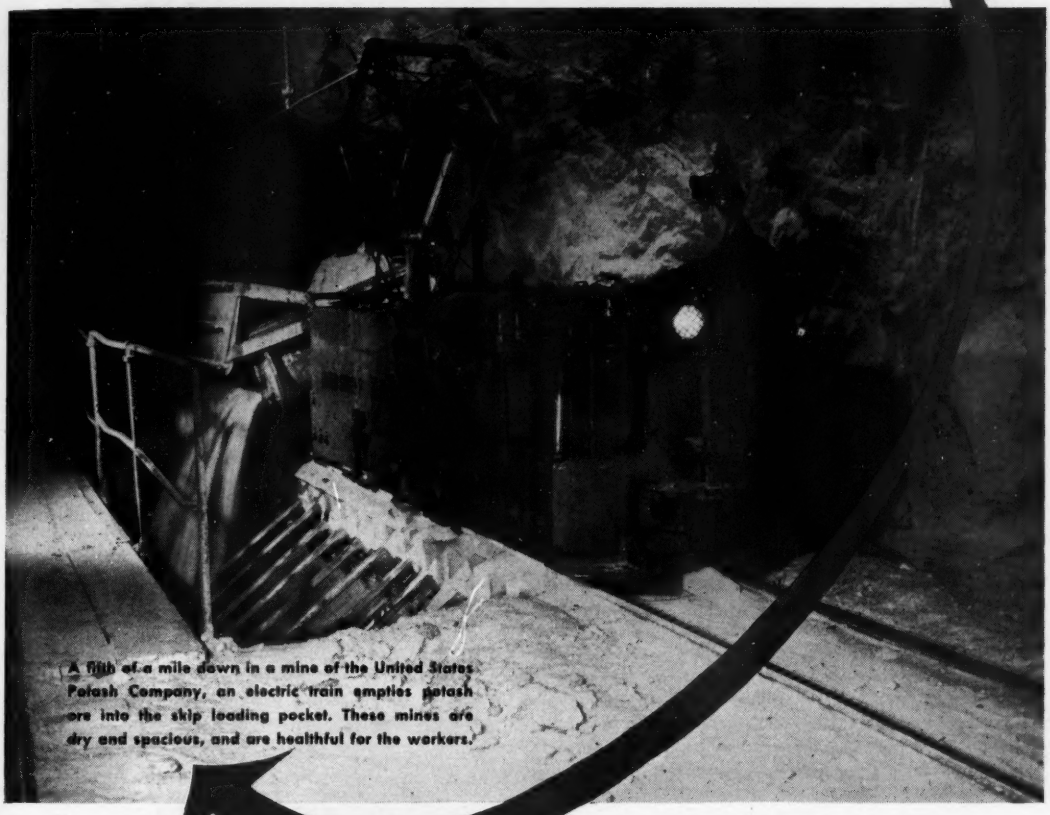

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To the Nation's farmers, potash means strong, healthy plants, with greater resistance to disease and drought. To you, Sunshine State Potash means uniform quality and careful sizing, that make blending easy and accurate.

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should reflect great credit on its designers and builders, and if private operators are ever able to finance similar construction and feel sure of steady output, this is one feature of the "Great Experiment" they will do well to copy.

The Missouri Pacific Railroad has issued a circular letter to phosphate shippers and receivers to the effect that the excess freight charged on bagged rock over bulk will soon be done away with, but it is still being collected.

CHARLESTON

Sulphate of Ammonia Allocation Still Awaited. Interest in Organics Continues.

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, July 14, 1942.

No definite information has come out yet as to the amounts of sulphate of ammonia that will be allocated to the manufacturers.

Nitrogenous.—Sellers of this material are still remaining out of the market and are closely sold up for July.

Blood.—This material continues to be used only for stock feed. The Chicago price from some sellers is $5.50 (6.68½ per unit N), f. o. b. Chicago, although other sellers are asking up to $5.70 ($6.93 per unit N).

Fish Meal.—There is not much interest in this material, the ground scrap being offered at $72.50 f. o. b. Chesapeake Bay.

Cottonseed Meal.—The 8 per cent grade is selling at $35.50 to $36.00 in Memphis; $38.00 in Atlanta.

PRACTICAL AGRONOMY IN WAR TIME

(Continued from page 11)

mining the best fertilizer ratio or analysis, the most profitable rate of addition, or the best method of application.

Since the beginning of agricultural chemistry over a century ago, the search for chemical methods of determining the fertilizer needs of soils has continued. Many methods have been proposed enthusiastically, only to fail when put to test. Thirty years ago most soil chemists had come to realize that the total content of plantfood in a soil was not a satisfactory basis on which to make a fertilizer recommendation.

During the past twenty-five years much progress has been made in the development of methods designed to measure the available plantfood content of soils and for determining their need for lime. The pH determination was first applied to soils about 1916, and in recent years pH determinations have been made on hundreds of thousands of soil samples annually. This determination, properly interpreted, probably gives more practical information concerning the needs of a soil than any other single test, but methods of determining available phosphorus, available potassium, and other plantfoods have been developed and are giving rather satisfactory results where the interpretation of the test is made by a competent person, and who is familiar with the soils of the State or area in which he is working and with the results of field experiments and farmers' experience on these soils. One valuable sign of progress is the fact that most of those who are now working with these tests realize that they are by no means infallible. Nevertheless, intelligently employed, they do enable the agronomist to make more accurate recommendations than he could make without them.

A Complete Service

THE strategic factory locations of the American Agricultural Chemical Company, as shown on the accompanying map, assure prompt, dependable service for the complete line of products listed below.

We manufacture all grades of Commercial Fertilizers, Superphosphate, Agrinite Tankage, Bone Black, Bone Black Pigments (Cosmic Black), Dicalcium Phosphate, Monocalcium Phosphate, Gelatin, Glue, Ground Limestone, Crushed Stone, Agricultural Insecticides (including Pyrox, Arsenate of Lead, Calcium Arsenate, etc.), Trisodium and Disodium Phosphate, Phosphorus, Phosphoric Acid, Sulphuric Acid, Salt Cake; and we are importers and/or dealers in Nitrate of Soda, Cyanamid, Potash Salts, Sulphate of Ammonia, Raw Bone Meal, Steamed Bone Meal, Sheep and Goat Manure, Fish, Blood and Tin-Tetrachloride. We mine and sell all grades of Florida Pebble Phosphate Rock.

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Cayce, S. C.
Chambly Canton, Quebec, Can.
Charleston, S. C.
Cincinnati, Ohio
Cleveland, Ohio
Detroit, Mich.
East Point, Ga.
East St. Louis, Ill.
Greensboro, N. C.
Havana, Cuba
Henderson, N. C.
Montgomery, Ala.
Norfolk, Va.
No. Weymouth, Mass.
Pensacola, Fla.
Pierce, Fla.
Port Hope, Ont., Can.
Presque Isle, Me.
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Wilmington, N. C.

The symptoms produced in the plant itself by deficiencies of the different plantfoods are now recognized to a far greater extent than they were only a few years ago. Such knowledge is invaluable to anyone who has occasion to advise farmers, whether he be an agronomist, horticulturist, county agent, vocational teacher, or fertilizer salesman. A valuable contribution in this field was, of course, the publication of "Hunger Signs in Crops" by your Association in cooperation with the American Society of Agronomy.

Chemical analysis of growing plants also promises to be a valuable aid in our study of plant and soil deficiencies, especially when used in connection with soil tests, field experiments, and the study of visible symptoms. In fact, we are rapidly developing in agronomy diagnostic procedures that are closely analogous to medical diagnosis.

We have learned much concerning the nature and value of soil organic study, the causes of its depletion, and methods for its conservation and increase. The vital place of sod and green manure crops in the rotation has been demonstrated. We are learning how to control the decomposition of crop residues so that the liberation of plant nutrients will best meet the demands of growing crops. More recently we have learned that it may be possible to control some of the most serious soil-borne plant diseases by properly controlling the microorganisms concerned with organic decay in the soil. We have learned that attention to the problem of soil organic matter is necessary if maximum results are to be obtained from fertilizer additions.

Cooperation in Grade Reduction

Although research is, by and large, the job of official agencies, and extension work —carrying the results of research to the farmer—is largely the function of the State and Federal extension services, industry can and does aid greatly in educating the farmer. In fact, I feel that industry has a responsibility in this connection and can best meet that responsibility as your industry and your Association have met it through cooperation with the official agencies. The research job is not complete until the practical application has been pointed out, and the extension job is not complete until the practice has been adopted by the farmer. This often means not until the farmer has signed an order for a new variety of seed, a new spray material, a new fertilizer distributor, or a recommended fertilizer.

I can well illustrate what I mean by referring to the work that has been done in getting farmers to use higher analysis fertilizers. Your industry has cooperated with the agricultural colleges and the United States Department of Agriculture in eliminating low analyses and unnecessary grades.

We tackled that job in Ohio in 1922. Some of you will recall the first grade conference that was held in Chicago that year between the agronomists of a few Middle Western States and members of the fertilizer industry. Some of you will recall the "Ohio Standard Dozen" fertilizers which were adopted at that time. In that year Ohio used 310,000 tons of fertilizer, 65 per cent of which consisted of superphosphate and a little bone meal, 31 per cent of mixed fertilizer averaging about 15 per cent total plantfood. In 1941 Ohio used 392,600 tons of fertilizer, 90 per cent of which consisted of mixed fertilizer averaging about 20 per cent total plantfood, and 82 per cent of it consisted of grades recommended by the College of Agriculture and Experiment Station. Similar progress has been made in many States. In a number of Southern States the number of grades sold has been limited by law or by administrative regulation. Recently I spent a year in North Carolina, where the number of grades sold is now limited by law and regulation to about 35. This compares with around 200 previously sold.

I am glad to say that the great majority of the members of your industry have cooperated heartily. In fact, the first steps in the campaign for higher analysis fertilizers and elimination of unnecessary grades were taken by your Association. I feel that collectively we have plowed the ground and put it in good condition for any further program of grade reduction that may be undertaken by the war agencies.

See Page 4

It has long been known that crops grown in different soils and with different fertilizers on the same soil vary in chemical composition, but it is only in recent years that we have recognized the great effect of soil and fertilization on the feed and food value of crops.

Now we know that many of the elements that are needed by growing plants are also essential to the growth, vigor, and health of animals and of human beings. Although many problems require further investigation in this field, we have already learned much that is useful. We have learned, for example, that if crops receive the right fertilizer to produce vigorous growth and high yield, they are likely to contain an abundance of most of the minerals needed for the nutrition of animals and man. This is especially true of the vital elements, calcium and phosphorus. Moreover, well-fertilized pastures, hay crops, vegetables, and fruits are more likely to contain certain of the essential vitamins.

I believe that, although the necessity of producing enough food is chiefly responsible for our interest in the fertilizer supply situation, those who are concerned with seeing that food supplies are provided for our armed forces and civilian population appreciate more than ever before the relationship between fertilizer use and food quality.

I have tried to point out that because of the great progress that has been made in recent years in the field of agronomy we are now in a much better position to produce crops efficiently and to feed our livestock and our people adequately than ever before in the history of this country. You as manufacturers also know how to make better fertilizers than ever before, and agronomists and others who advise farmers are able to make more accurate and more practical recommendations than they could have made without the knowledge gained through progress in soil and crop research. Thus, agronomy, including as it does the scientific knowledge of fertilizers and fertilizer use, takes its place alongside the other fields of science which are bound to play such an important role both in winning the war and in making possible a better life for a free people after the war.

ANALYSIS OF THE PRODUCTION OF ORDINARY SUPERPHOSPHATE IN THE UNITED STATES IN THE CALENDAR YEARS 1940-1941

(Continued from page 8)

because of the lack of sufficient information on certain companies listed in the respective issues of *The American Fertilizer* Hand Book as producers of superphosphate.

Productive and Storage Capacities of Superphosphate Plants

The total annual productive capacity of all active superphosphate plants (146) in the United States is estimated at 9,483,000 short tons of equivalent 16 per cent superphosphate, or an average of 64,950 tons per plant, as of December 31, 1941 (Table 3). This estimate is based on the assumption that adequate supplies of phosphate rock, sulphuric acid and labor are available, that two or more shifts are operated, that the superphosphate is removed from the plants at the end of the normal curing period or within 60 to 90 days, and that there is no interference in the normal functioning of the plants for other purposes, for example, the manufacture of mixed fertilizers. In addition, the total productive capacity of the seven inactive plants that could be placed in operation without extensive repair and (or) purchase of new equipment, is estimated at 265,500 tons of equivalent 16 per cent superphosphate. The total productive capacity of active plants that also have acid-making facilities, is estimated at 6,106,000 tons, or an average of 80,350 tons per plant, as compared to 3,377,000 tons (average 48,250 tons) for plants not having such facilities.

The only previous figures on superphosphate-plant capacity are those published by the National Fertilizer Association in 1938,[2] which show a total capacity of 8,844,080 short tons of run-of-pile ordinary superphosphate. As the total production of run-of-pile superphosphate averaged about 19.25 per cent of available P_2O_5 in 1938, the total capacity for that year was equivalent to approximately 10,641,000 tons of 16 per cent material. It should be borne in mind, however, that this estimate is for 191 plants, some of

[2] Fertilizer Review 13, No. 2, 8, 12 (1938).

which were known to be inactive. The 191 plants included 98 that had coexisting acid-making facilities.

From the standpoint of regional distribution, the present survey shows that 57.5 per cent of the annual productive capacity is located in the South, 23.6 per cent in the Middle Atlantic States, 14.7 per cent in the Midwest, 2.5 per cent in New England, 1.7 per cent in California and Michigan (Table 10). Only two states have plant capacities exceeding a million tons, namely Maryland and Georgia with 1,472,600 and 1,279,700 tons, respectively, or 15.6 and 13.5 per cent of the country's total. The average capacity per plant ranges from 38,550 tons in Mississippi to 245,450 tons in Maryland. The capacities of the individual plants throughout the country range from 4,000 to more than 400,000 tons. The currently active plants comprise 15 with individual capacities of less than 25,000 tons, 58 with 25,000 to 49,999 tons, 33 with 50,000 to 74,999 tons, 20 with 75,000 to 99,999 tons and 20 with 100,000 or more tons. Of the plants with capacities of 100,000 or more tons, 11 are in the South, 8 in the Middle Atlantic States, and 1 in the Midwest.

The total storage capacity for ordinary superphosphate and wet-mixed base of all active producing plants is estimated at 2,124,100 short tons of equivalent 16 per cent superphosphate, or an average of 14,550 tons per plant, as of December 31, 1941 (Table3). As with the estimate of productive capacity, this figure is based on the assumption that there is no interference in the normal functioning of the plants for other purposes. In addition, the total storage capacity of the seven inactive plants is estimated at 60,800 tons.

The storage capacities of the individual active plants range from 2.5 to 100 per cent of the respective annual productive capacities. Based on the arithmetical average of the figures for individual plants the relation of storage capacity to productive capacity is 26.5 per cent for the entire country; the relation is 22.5 per cent on the basis of the total storage and productive capacities. Classification of the plants according to the different ranges in the relation between storage capacity and productive capacity places them in the following groups: 4 plants, less than 10 per cent; 45 plants, 10 to 19.9 per cent; 57 plants, 20 to 29.9 per cent; 21 plants, 30 to 39.9 per cent; 11 plants, 40 to 50 per cent; and 8 plants, greater than 50 per cent. The respective total productive capacities of the plants in these groups are 559,800, 3,771,100, 3,681,200, 769,200, 423,600, and 278,000 tons; the averages per plant are 139,950, 83,800, 64,600, 36,650, 38,500, and 34,750 tons. Clearly, the percentage relation between storage capacity and productive capacity tends to increase with decrease in the productive capacity per plant.

Table 4

Storage Capacity for Sulphuric Acid at Plants Making Ordinary Superphosphate and (or) Wet-mixed Base

(The data relate only to active plants.)

Region	Plants having coexisting acid-making facilities		Plants not having coexisting acid-making facilities	
	Number	Short Tons[1]	Number	Short Tons[1]
New England[2]	..	.....	..	.....
Middle Atlantic	8	73,460	6	5,320
Southern	57	46,575	42	19,278
Midwest[3]	7	10,250	19	11,144
Undistributed[4]	4	600	3	700
United States	76	130,885	70	36,442

[1] Expressed as 50° Baumé acid.
[2] Included with undistributed States.
[3] Except Michigan, which is included with undistributed States.
[4] California, Michigan, and New England States (Massachusetts).

As shown in Table 4, the total storage capacity for sulphuric acid at all active plants is equivalent to only 167,327 tons of 50° Baumé material, or an average of 1,146 tons per plant. These figures do not include the capacity for acid storage in chamber bottoms. The average for plants having acid-making facilities is 1,722 tons as against 521 tons for those not having such facilities. Of the plants in the first group, 17 have no extra-chamber storage space, 25 have facilities for the storage of less than 500 tons each, 17 have storage for 500 to 1,000 tons, 12 for 1,050 to 5,000 tons, and only 5 for more than 5,000 tons. In the second group, 14 plants have storage for less than 150 tons each, 30 for 150 to 300 tons, 21 for 350 to 1,000 tons, and 5 for more than 1,000 tons.

(To be continued in the next issue)

BUYERS' GUIDE • A CLASSIFIED INDEX TO ALL THE ADVERTISERS IN "THE AMERICAN FERTILIZER"

This list contains representative concerns in the Commercial Fertilizer Industry, Including fertilizer manufacturers, machinery and equipment manufacturers, dealers in and manufacturers of commercial fertilizer materials and supplies, brokers, chemists, etc.
For Alphabetical List of Advertisers, see page 33.

ACID BRICK
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

ACID EGGS
Chemical Construction Corp., New York City.

ACIDULATING UNITS
Chemical Construction Corp., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

AMMO-PHOS
American Cyanamid Co., New York City.

AMMONIA—Anhydrous
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA LIQUOR
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA OXIDATION UNITS
Chemical Construction Corp., New York City.

AMMONIATING EQUIPMENT
Sackett & Sons Co., The A. J., Baltimore, Md.

AMMONIUM NITRATE SOLUTIONS
Barrett Division, The, Allied Chemical & Dye Corp., New York City.

AUTOMATIC ELEVATOR TAKEUPS
Sackett & Sons Co., The A. J., Baltimore, Md.

BABBITT
Sackett & Sons Co., The A. J., Baltimore, Md.

BAGS AND BAGGING—Manufacturers
Bagpak, Inc., New York City.
Bemis Bro. Bag Co., St. Louis, Mo.

BAGS—Cotton
Bemis Bro. Bag Co., St. Louis, Mo.

BAGS—Paper
Bagpak, Inc., New York City
Bemis Bro. Bag Co., St. Louis, Mo.

BAGS (Waterproof)—Manufacturers
Bemis Bro. Bag Co., St. Louis, Mo.

BAGS—Dealers and Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

BAGGING MACHINES—For Filling Sacks
Atlanta Utility Works, East Point, Ga.
Bagpak, Inc., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

BAG PILERS
Link-Belt Company, Philadelphia, Chicago.

BEARINGS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

BELT LACING
Sackett & Sons Co., The A. J., Baltimore, Md.

BELTING—Chain
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

BELTING—Leather, Rubber, Canvas
Sackett & Sons Co., The A. J., Baltimore, Md.

BOILERS—Steam
Atlanta Utility Works, East Point, Ga.

BONE BLACK
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Huber & Company, New York City.

BONE PRODUCTS
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

BORAX AND BORIC ACID
American Potash and Chem. Corp., New York City.
Pacific Coast Borax Co., New York City.

BROKERS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Dickerson Co., The, Philadelphia, Pa.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Keim, Samuel L., Philadelphia, Pa.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

BUCKETS—Elevator
Link-Belt Company, Philadelphia, Chicago
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

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BUCKETS—For Hoists, Cranes, etc., Clam Shell, Orange Peel, Drag Line, Special; Electrically Operated and Multi Power
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.

BURNERS—Sulphur
Chemical Construction Corp., New York City.

BURNERS—Oil
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.

CABLEWAYS
Hayward Company, The, New York City.

CARBONATE OF AMMONIA
American Agricultural Chemical Co., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.

CARS—For Moving Materials
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CARTS—Fertilizer, Standard and Roller Bearing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

CASTINGS—Acid Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Durirc Co., Inc., The, Dayton, Ohio.

CASTINGS—Iron and Steel
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CEMENT—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

CHAIN DRIVES—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAINS AND SPROCKETS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAMBERS—Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CHEMICAL APPARATUS
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

CHEMICALS
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Huber & Company, New York City.

CHEMICALS—Continued
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Phosphate Mining Co., The, New York City.
Wellmann, William E., Baltimore, Md.

CHEMICAL PLANT CONSTRUCTION
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHEMISTS AND ASSAYERS
Gascoyne & Co., Baltimore, Md.
Shuey & Company, Inc., Savannah, Ga.
Stillwell & Gladding, New York City.
Wiley & Company, Baltimore, Md.

CLUTCHES
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CONCENTRATORS—Sulphuric Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CONDITIONERS AND FILLERS
American Limestone Co., Knoxville, Tenn.
Dickerson Co., The, Philadelphia, Pa.
Phosphate Mining Co., The, New York City.

CONTACT ACID PLANTS
Chemical Construction Corp., New York City.

COPPER SULPHATE
Tennessee Corporation, Atlanta, Ga.

COTTONSEED PRODUCTS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

CRANES AND DERRICKS
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

CYANAMID
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Jett, Joseph C., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

DENS—Superphosphate
Chemical Construction Corp., New York City.
Stedman's Foundry and Mach. Works, Aurora, Ind.

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Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DRYERS—Direct Heat
Sackett & Sons Co., The A. J., Baltimore, Md.

DRIVES—Electric
Link-Belt Company, Philadelphia, Chicago.

DUMP CARS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DUST COLLECTING SYSTEMS
Sackett & Sons Co., The A. J., Baltimore, Md.

ELECTRIC MOTORS AND APPLIANCES
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

ELEVATORS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ELEVATORS AND CONVEYORS—Portable
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

ENGINEERS—Chemical and Industrial
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ENGINES—Steam
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

EXCAVATORS AND DREDGES—Drag Line and Cableway
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Link Belt Speeder Corp., Chicago, Ill., and Cedar Rapids, Iowa.

FERTILIZER MANUFACTURERS
American Agricultural Chemical Co., New York City.
American Cyanamid Company, New York City.
Armour Fertilizer Works, Atlanta, Ga.
Farmers Fertilizer Company, Columbus, Ohio.
International Minerals and Chemical Corporation, Chicago, Ill.
Phosphate Mining Co., The, New York City.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

FOUNDERS AND MACHINISTS
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GARBAGE TANKAGE
Wellmann, William E., Baltimore, Md.

GEARS—Machine Moulded and Cut
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GEARS—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

GELATINE AND GLUE
American Agricultural Chemical Co., New York City.

GUANO
Baker & Bro., H. J., New York City.

HOISTS—Electric, Floor and Cage Operated, Portable
Hayward Company, The, New York City.

HOPPERS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

IMPORTERS, EXPORTERS
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Wellmann, William E., Baltimore, Md.

IRON SULPHATE
Tennessee Corporation, Atlanta, Ga.

INSECTICIDES
American Agricultural Chemical Co., New York City.

LACING—Belt
Sackett & Sons Co., The A. J., Baltimore, Md.

LIMESTONE
American Agricultural Chemical Co., New York City.
American Limestone Co., Knoxville, Tenn.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

LOADERS—Car and Wagon, for Fertilizers
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Duriron Co., Inc., The, Dayton, Ohio.
Fairlie, Andrew M., Atlanta, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Coal and Ash Handling
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Elevating and Conveying
Atlanta Utility Works, East Point, Ga.
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Grinding and Pulverizing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

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Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Pumping
Atlanta Utility Works, East Point, Ga.
Duriron Co., Inc., The, Dayton, Ohio.

MACHINERY—Tankage and Fish Scrap
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MAGNETS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MANGANESE SULPHATE
McIver & Son, Alex. M., Charleston, S. C.
Tennessee Corporation, Atlanta, Ga.

MIXERS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

NITRATE OF SODA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
Chilean Nitrate Sales Corp., New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

NITRATE OVENS AND APPARATUS
Chemical Construction Corp., New York City.

NITROGEN SOLUTIONS
Barrett Division, The, Allied Chemical & Dye Corp., New York City.

NITROGENOUS ORGANIC MATERIAL
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
DuPont de Nemours & Co., Wilmington, Del.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Smith-Rowland Co., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.

PACKING—For Acid Towers
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

PANS AND POTS
Stedman's Foundry and Mach. Works, Aurora, Ind.

PHOSPHATE MINING PLANTS
Chemical Construction Corp., New York City.

PHOSPHATE ROCK
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Charleston Mining Co., Inc., Richmond, Va.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Phosphate Mining Co., The, New York City.
Ruhm, H. D., Mount Pleasant, Tenn.
Schmaltz, Jos. H., Chicago, Ill.
Southern Phosphate Corp., Baltimore, Md.
Wellmann, William E., Baltimore, Md.

PIPE—Acid Resisting
Duriron Co., Inc., The, Dayton, Ohio.

PIPES—Chemical Stoneware
Chemical Construction Corp., New York City.

PIPES—Wooden
Stedman's Foundry and Mach. Works, Aurora, Ind.

PLANT CONSTRUCTION—Fertilizer and Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

POTASH SALTS—Manufacturers
American Potash and Chem. Corp., New York City.
Potash Co. of America, New York City.
International Minerals & Chemical Corp., Chicago, Ill.
United States Potash Co., New York City.

PULLEYS AND HANGERS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

PUMPS—Acid-Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., New York City.
Wellmann, William E., Baltimore, Md.

QUARTZ
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

RINGS—Sulphuric Acid Tower
Chemical Construction Corp., New York City.

ROUGH AMMONIATES
Bradley & Baker, New York City.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

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Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SCRAPERS—Drag
Hayward Company, The, New York City.

SCREENS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

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